

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

To:

DUNLOP, Alan J.S. et al.  
HAHN & HAHN INC.  
222 Richard Street  
Hatfield  
0083 Pretoria  
AFRIQUE DU SUD



### NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing  
(day/month/year)

07.12.2004

Applicant's or agent's file reference  
PCT/ZA03/00111/PV/

#### IMPORTANT NOTIFICATION

International application No.  
PCT/ZA 03/00111

International filing date (day/month/year)  
14.08.2003

Priority date (day/month/year)  
16.08.2002

Applicant  
SASOL TECHNOLOGY (PTY) LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international  
preliminary examining authority:



European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized Officer

Taylor, K

Tel. +49 89 2399-6173





# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT/ZA03/00111/PV/		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)
International application No. PCT/ZA 03/00111	International filing date ( <i>day/month/year</i> ) 14.08.2003	Priority date ( <i>day/month/year</i> ) 16.08.2002
International Patent Classification (IPC) or both national classification and IPC B01J23/85		
Applicant SASOL TECHNOLOGY (PTY) LIMITED et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 4 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand  03.11.2003		Date of completion of this report  07.12.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Holzwarth, A  Telephone No. +49 89 2399-7269 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/ZA 03/00111

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-15 as originally filed

**Claims, Numbers**

1-25 received on 27.10.2004 with letter of 25.10.2004

**Drawings, Sheets**

1-5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
  - ☐ the language of publication of the international application (under Rule 48.3(b)).
  - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:
- ☐ contained in the international application in written form.
  - ☐ filed together with the international application in computer readable form.
  - ☐ furnished subsequently to this Authority in written form.
  - ☐ furnished subsequently to this Authority in computer readable form.
  - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
  - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
4. The amendments have resulted in the cancellation of:
- ☐ the description, pages:
  - ☐ the claims, Nos.:
  - ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 23-25

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 23-25

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the Standard.

☐ the computer readable form has not been furnished or does not comply with the Standard.

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	2-9,11-17,19-22
	No: Claims	1,10,18
Inventive step (IS)	Yes: Claims	2,3,4,11,15
	No: Claims	5-10,12-14,16-22
Industrial applicability (IA)	Yes: Claims	1-25
	No: Claims	

2. Citations and explanations

**see separate sheet**

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**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

D1: EP-A-0434123

D2: EP-A-0317034

D3: EP-A-0266010

**1. The present application does not meet the requirements of Article 33 PCT, in the following respects:**

**1.1 D1** (page 2, line 50 - page 3, line 13; page 3, lines 25-36; page 5, lines 8-19; page 8, lines 8-18; table 2; claims 1, 2, 5, 11,12) discloses a olefin metathesis catalyst, which is prepared by mixing a tungsten or a molybdenum oxide anion containing aqueous solution with an alumina support at a pH between 4 - 10, followed by drying and calcination (removing water by evaporation). The catalyst is contacted in a metathesis process with a feed stream of decenes at a temperature between 10°C - 350 °C.

**Therefore the subject matter of at least the claims 1, 10, 18 is not novel in view of D1.**

**1.2** Similar preparation processes as in D1 for the preparation of tungsten oxide containing catalysts are disclosed in **D2** (claims 1,6) and **D3** (claims 1,5).

**Therefore the subject matter of at least the claims 1, 10 is not novel in view of D2 and D3.**

**1.3** As can deduced from the above points (2.1-2.4) at least the subject matter of the claims 1, 10, 18 is not novel (Art. 33(1) and 33(2) PCT) and therefore does not satisfy the requirements of Article 33 PCT.

**1.4** Claim 2-4, 11 and 15, which refer to "silica" as the carrier and "tungsten transition metal anions" contain novel subject matter, for which also an inventive step could be acknowledged, since the example section shows an effect for pH values higher then 9 for the combination "silica carrier" and "tungsten transition metal anions".

For the other combinations at present no inventive step can be acknowledged since these combination would be considered as being an arbitrary selection of ranges given in D1 and/or within the competence of a person skilled in the art.

An inventive step could only be acknowledged in the presence of further experimental

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evidence (examples), which could be used to support an effect for other combinations of "carriers" and "transition metal anions". Mere statements of beneficial effects are not sufficient.

**1.5** Dependent claims 5-9, 12-14, 16-17, 19-22 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to novelty and/or inventive step, because said additional features are either disclosed in the prior art documents (see above) or are trivial or within the competence of a skilled person looking for alternative catalysts or processes.

**1.6** Claims 23-25 have not been searched and therefore will not be examined.

REPLACED BY  
ART 34 ABST**Claims**

1. A method of preparing a metathesis catalyst, the method including the steps of:
  - 5 mixing a transition metal oxide containing aqueous solution having a pH of 9 or higher with a carrier; and
  - removing water from the mixture by means of evaporation.
2. A method as claimed in Claim 1, wherein the carrier is silica and  
10 the transition metal is tungsten.
3. A method as claimed in Claim 2, wherein the aqueous solution contains tungsten in the form of ammonium metatungstatehydrate and/ or ammonium tungstate.  
15
4. A method as claimed in Claim 3, wherein the aqueous solution contains tungsten in the form of ammonium metatungstatehydrate and wherein the concentration of the ammonium metatungstatehydrate and the mass of the silica are selected such that the  $WO_3$  on the  $SiO_2$  is from 4 to 10  
20 wt%.
5. A method of preparing a metathesis catalyst as claimed in any one of claims 1 to 4, wherein excess water is removed by evaporation at about 80°C under reduced pressure to form a residue.  
25
6. A method of preparing a metathesis catalyst as claimed in Claim 5, wherein further water is removed after removal of the excess water by drying the residue at about 110°C for about 12 hours, then by raising the temperature at a rate of about 1°C every minute up to about 250°C,  
30 maintained at about 250°C for about two hours and then by raising the temperature at a rate of about 3°C every minute up to about 550°C.
7. A method of preparing a metathesis catalyst as claimed in Claim 6, wherein the residue is then calcined.

8. A method of preparing a metathesis catalyst as claimed in Claim 7, wherein the residue is calcined at about 550°C for about 8 hours.
- 5 9. A method of preparing a metathesis catalyst as claimed in Claim 7, wherein the residue is calcined at a temperature and for duration such that the calcination step substantially removes  $\text{NH}_3$ , ensures that the oxidation state of the tungsten is mostly 6+ and ensures that the tungsten oxide is bound to the carrier.
- 10 10. A catalyst for metathesis of an olefinic feed stream, which includes:  
a transition metal oxide; and  
a carrier, the transition metal oxide being deposited onto the carrier  
15 from an aqueous solution of transition metal oxide anions at a pH of 9 or more so that the transition metal oxide is substantially uniformly distributed on the surface of the carrier.
- 20 11. A catalyst as claimed in Claim 10, wherein the transition metal is tungsten and the carrier is silica.
12. A catalyst as claimed in Claim 10 or Claim 11, wherein the catalyst is a heterogeneous catalyst.
- 25 13. A catalyst as claimed in Claim 11 or Claim 12, wherein most of the tungsten oxide deposits are substantially amorphous.
14. A catalyst as claimed in any one of claims 11 to 13, wherein the catalyst is characterised in that at least a portion of some of the tungsten  
30 oxide deposits are in the form crystallites of less than about 135 Å across on the surface of the carrier.
15. A catalyst as claimed in any one of the claims 11 to 14, wherein the tungsten oxide is from about 4 to 10 wt% on  $\text{SiO}_2$ .



16. A catalyst as claimed in any one of the claims 11 to 15, wherein the catalyst is characterised in that it remains catalytically active for at least 1000 hours at optimal operating conditions.
- 5 17. A catalyst as claimed in any one of the claims 11 to 16, wherein the catalyst is characterised in that it provides a conversion rate of at least 30% for at least 50 hours at optimal operating conditions.
- 10 18. A metathesis process, which includes the step of:  
contacting a C<sub>5</sub> and/ or higher olefinic feed stream with a catalyst for metathesis as claimed in any one of claims 1 to 8 at a temperature of between 350°C and 600°C.
- 15 19. A metathesis process as claimed in Claim 18, wherein the process includes a step of activating the catalyst at about 500 to 700°C for about 8 hours in an inert atmosphere.
- 20 20. A metathesis process as claimed in Claim 19, wherein the olefinic feed stream is selected such that the process yields C<sub>10</sub> to C<sub>18</sub> olefins.
21. A metathesis process as claimed in Claim 18 or Claim 19, wherein the feed stream is contacted with the catalyst at a LHSV of between 5 and 25 h<sup>-1</sup> at a temperature of between 350 and 550°C.
- 25 22. A metathesis process as claimed in any one of claims 18 to 21, wherein the feed stream is contacted with the catalyst at a pressure of 0.1 to 10 atm.
- 30 23. A product produced by the process as claimed in any one of claims 18 to 22.
24. A product as claimed in Claim 23, wherein the product includes C<sub>8</sub> to C<sub>20</sub> internal olefins.

25. A product as claimed in Claim 24, wherein the C<sub>8</sub> to C<sub>20</sub> internal olefins are mostly linear.
26. A product as claimed in Claim 25, wherein the feed stream of  
5 the process is predominantly a linear alpha-olefin and the product comprise of at least 4% of a corresponding primary metathesis product and at least 40% of a linear olefin product.
27. A catalyst for metathesis of an olefinic feed stream substantially  
10 as described herein with reference to the accompanying graphs and schemes.
28. A method of preparing a metathesis catalyst substantially as described herein with reference to the accompanying graphs and schemes.
- 15 29. A metathesis process substantially as described herein with reference to the accompanying graphs and schemes.
30. A product produced by the process substantially as described herein with reference to the accompanying graphs and schemes.